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Stereotactic body irradiation (SBRT) in patients with exclusive CTPET-based diagnosis of lung malignancies

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Purpose/Objective: To evaluate the appropriateness of SBRT in pts with T1-2 lung cancer diagnosed with only CT-PET imaging.
Materials and Methods: Between September 2009 and August 2012, 37 T1-2 lung cancer pts underwent SBRT with Helical Tomotherapy . 17 of the 37 pts had biopsy proven malignancy while in the remaining 20 pts diagnosis was only based on CTPET imaging because they were unfit for any invasive procedure. Pts were treated with 60Gy/6fx, 52Gy/4fx, 50Gy/5fx or 48Gy/4fx according to nodule diameter and location inside the chest.
Results: 33/37 pts were eligible for evaluation; they have a minimum follow up of 3 mns. Median follow up was 12 mns (range 3-33). Of these 33 pts, 17 (group A) had had biopsy while 16 (group B) had CTPET-based diagnosis of malignancy. Pts in group A were staged as follows: 12 pts T1 and 4 T2 and there were 3 NSCLC nos, 11 adenoca and scc. In group A 6 pts (35.3%) and 5 pts (29.4%) had local and distant relapse, respectively. In pts in group B there were 4 (25%) and 3 (18.7%) local and distant relapses. There were no statistical difference in local or distant relapse between the 2 groups.
Conclusions: Despite the small number of pts considered, the two groups showed no difference in outcome and this evidence could suggest that CTPET may be a reliable tool to select pts unfit for invasive diagnostic procedures for SBRT.

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Stereotactic radiotherapy for moving targets with the active breathing control

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Purpose/Objective: The treatment of moving lesions is one of the most important problems in radiotherapy. In the case of conventional radiotherapy treatment planning 15-20 mm margin from the edge of the clinical target volume (CTV) is applied. It significantly increases an irradiated volume that leads to the risk of the radiation-induced toxicity. One of the effective ways to minimize absorbed dose in normal tissue is the usage of breath-holding techniques. This study provides the utilization efficiency estimation of active breathing control (ABC) for radiotherapy of moving targets such as lesions in lung and liver.
Materials and Methods: Thirty-five patients were treated in the Centre for Stereotactic Radiotherapy and Radiosurgery in Novosibirsk Research Institute for Circulation Pathology by stereotactic radiotherapy (SBRT) with breath-holding at inhale. Twenty-one patients had primary lung malignant lesions, pulmonary metastases were in nine cases, and five patients had a liver metastatic tumors. The 2 mm-thick slices CT simulation scans were performed with the intravascular contrast during breath-holding. The clinical target volume (CTV) included the gross target volume (GTV) plus 3-5 mm margin. For each fraction all patients received pre- and post-treatment cone beam CT scans with ABC.
Results: All patients completed the prescribed radiotherapy treatment with ABC. Because of ABC usage, margin from the clinical target volume (CTV) to the planning target volume (PTV) was significantly reduced up to 7±3 mm. The average breath-holding time was 18 sec. ABC allows to significantly increase of the total delivered dose. For lung primary tumors the mean dose was 74±4 Gr with 2 Gr per fraction, or 54 Gr in 3 fractions for SBRT cases; for pulmonary metastasis 20 Gr in one fraction was prescribed; for liver metastasis the dose was 45 Gr in three fractions. The intermediate results showed no signs of disease progression in 66% of the cases. 15% of the cases had a partial reduction. There was a disease progression requiring polychemotherapy in 14% of the cases. For 5% of the patients, the size of the lesion remained the same.
Conclusions: The radiotherapy treatment of the moving lesions with ABC at inhale is an effective method to reduce organ motion during treatment. Thereafter, the procedure requires smaller PTV margins and allows to minimize the absorbed dose to the normal tissues as well as the risk of radiation-induced toxicity.

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Intensity modulated radiotherapy after extrapleural pneumonectomy in malignant pleural mesothelioma patients

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Purpose/Objective: The impact of radiation therapy (RT) and the optimal techniques in the trimodal treatment concepts of malignant pleural mesothelioma (MPM) are subject of current investigations. Based on our previous report that demonstrated improved dose coverage by using IMRT in comparison to 3D-conformal RT (3D-CRT) (Krayenbuehl et al. IJROBP 2007) we have now reviewed the clinical outcome with IMRT after neoadjuvant chemotherapy and extrapleural pneumonectomy (EPP).
Materials and Methods: From 2005 to 2011 fourteen patients with stage 1-3 MPM were treated in a curative intent with adjuvant IMRT, 3 cycles of neoadjuvant chemotherapy and EPP. IMRT was planned on Eclipse (Varian Medical System) using 5-7 coplanar beams to a total median dose of 56 Gy (54-60 Gy) with an integrated simultaneous boost to the high risk area in 12 patients or in 2 phases in 2 patients. We evaluated the locoregional recurrence, disease free survival and overall survival for 14 IMRT patients and 25 3D-CRT patients. The latter were treated in the pre IMRT era between 1999 and 2005. Local recurrence was defined as relapse in the radiation field or at the field border. A matched-pair analysis was performed on 11 patients in each group.
Results: The median age at diagnosis was 61 years (46-72) and the median follow up was 15.5 ± 15.7 months for the IMRT group and 13.6 ± 9.2 months for the 3D-CRT group.
For patients included in the matched-pair analysis, the local control was 73% vs. 27% in IMRT vs. 3D-CRT treated patients (p=0.06). The median time to local relapse after IMRT was 15.6 ± 3.3 months and 11.0 ± 5.5 months after 3D-CRT (p=0.31). The median overall survival and disease free survival after IMRT and 3D-CRT were 22.4 ± 16.2 vs. 21.5 ± 9.3 months (p=0.57) and 17.3 ± 12.3 vs. 11.4 ± 8.6 months (p = 0.72). Taking into account all patients 4 IMRT treated patients (28.6 %) and 12 patients in the 3D-CRT-group (48%) had local failure. In the IMRT (respectively 3D-CRT) groups 71.4%—(resp. 80%) had distant recurrences (p=0.70).
Conclusions: Our data indicates that the use of IMRT might improve local control, time to local relapse and disease free survival after EPP but has little impact on distant recurrence and overall survival.

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Are there any dosimetric advantages in using VMAT for treatment of locally advanced non-small cell lung cancer ?

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Purpose/Objective: To analyze the dosimetric differences between the conventional conformal radiation therapy (CR) and the volumetric modulated arc therapy (VMAT) for locally advanced non-small-cell lung cancer (NSCLC).
Materials and Methods: Two plans (CR and VMAT) were calculated for ten patients with locally advanced NSCLC. Both treatment plans were generated by 'Eclipse' (Varian, CA) for a linear accelerator 'Trilogy' with heterogeneity correction (Analytical Anisotropic Algorithm). Sixty six Gy in 33 fractions was prescribed in both cases. Four to five 6 MV photon beams were used for the CR and two arc with 6 MV beam for the VMAT. Dose to PTV, organs at risk and external contours (body), conformity index (PTV volume/volume of the 95% reference isodose) and homogeneity index ([maximal dose - minimaldose]/dose prescription) were compared.
Results: Doses delivered to PTV (homogeneity index, maximal,minimal and mean dose) are similar with both techniques but conformity index is improved by 60% with VMAT: from 0.55 ± 0.07 with CR to 0.89 ± 0.07 with VMAT (P = 0.002). Pulmonary protection is improved with VMAT: with CR and VMAT, respectively, the mean lung dose is 14.1 ± 5.2 Gy and 12.2 ± 4.5 Gy, the lung volume which receives at least 30Gy (V30) is 20±8% and14±5%, and the V20 is 24±11% and 20±10% (P=0.002). The mean dose received by the body is also 9% lower (P = 0.004) and V5 is 13% higher (P = 0.004) with VMAT. V10 and V15 were similar with both modalities. From 20 Gy and higher, irradiated body volume is larger with CR than with VMAT. The relative difference increases with the dose: from 10% for 20 Gy (P = 0.014) up to 39% for 62.7 Gy (P =0.002).